2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
Paper ID #50789

Work in Progress: Assessment of Team Dynamics in a Multidisciplinary Capstone Design Course Collaboration

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Abstract

Starting in Fall 2024, we experimented with a new variation of the Electrical and Computer Engineering Capstone course at the University of Kentucky by embedding 3rd year Product Design students into select capstone teams. This paper presents an initial assessment of the success of the collaboration by analyzing two course outcomes: student responses to teammate evaluations, and the number of teams that stayed together into an optional second semester of collaboration. The first iteration of the course collaboration showed promising results, as product design students were rated highly on teammate evaluations, and six of the seven product design students chose to stay with their teams into an optional second semester of the project. The second iteration of the collaboration showed lower team unity according to the teammate evaluations, and only one team stayed together into the optional second semester. We discuss possible reasons for this apparent decrease in the success of the collaboration and provide recommendations for design educators who are organizing multidisciplinary collaborations in capstone design courses.

1. Introduction

Instead of educating graduates within disciplinary silos, engineering education must transform to more effectively meet the evolving needs of industry [1]. Industry leaders design graduates that possess the skills of multidisciplinary teamwork, effective communication, critical thinking, and design and innovation [1], [2]. One way that engineering education can evolve to meet these industry expectations is by embracing multidisciplinary courses [3], [4]. Capstone design courses are an ideal setting for meeting these needs, as capstone design projects are well-positioned to play a significant role in facilitating multidisciplinary engineering education and improving cross-disciplinary communication skills among engineering students [5], [6], [7]. Multidisciplinary collaborative course designs occur most commonly in capstone courses and typically involve multiple engineering disciplines. However, there is also a growing trend toward involving non-engineering students from other colleges [7].

In this paper, we describe a collaboration between an electrical and computer engineering (ECE) capstone design course and a product design (PRD) studio course at a large public university. The course instructors were motivated to begin this collaboration for different reasons. The ECE instructor wanted to diversify the skills on the student teams because many typical capstone projects require mechanical design and physical building, skills that are not taught in the ECE required courses. The PRD instructor had an existing collaboration with biomedical engineering capstone course but wanted to expand the number of project opportunities available to the PRD students. The ECE capstone was appealing because the ECE students appeared to have complementary skills to those of the PRD students, as the ECE students were experienced with designing and prototyping electronics, and the PRD students were experienced in conceptual design and designing and prototyping product housings.

We faced various logistical challenges, including the fact that the students were enrolled in two different courses with different meeting times. In this paper, we aim to evaluate the success of the first two iterations of our interdisciplinary collaboration through an analysis of the teammate evaluation form responses, and a count of how many teams opted to stay together for a second semester. Our goal was to understand how effectively the PRD students were being incorporated into ECE capstone teams.

2. Literature Review

2.1 Multidisciplinary Capstone Courses

Multiple studies have identified advantages to multidisciplinary design course approaches [8], [9], [10], [11]. Most multidisciplinary capstone courses described in the literature involve a two semester collaboration where all students are enrolled for the full project duration [12]. There are also a few exceptions, for example, in one course, mechanical engineering technology and electrical engineering students participated for two semesters, while computer science students participated only in the second semester [11]. One advantage of this structure was that the projects were far enough along that the teams could clearly identify which projects included adequate work for the computer science students to take on.

While many papers describe multidisciplinary engineering courses, few describe collaborations which included product design students [12], though there are examples of collaborations between biomedical engineering and product design students [12], [13]. Although design is taught both in engineering and in applied arts disciplines like product design, the approaches to design education are quite different. Engineering education emphasizes applied math and science, and students are typically expected to utilize this training in devising design solutions. Engineering students typically do not have the skills to make a design solution look aesthetically pleasing or market-ready and may focus more on proof-of-concept designs. Product design students typically do not have the math and science training to ensure that a design will meet technical requirements, as their training emphasizes hands-on problem solving, creativity, usability, and aesthetics [12].

2.2 Team Dynamics in Multidisciplinary Capstone

Literature identifies multiple factors that contribute to team effectiveness and enjoyment in multidisciplinary capstone courses. These factors include clear roles for students, alignment between student interests, skills, and assigned tasks, similar expectations within the team regarding final outcomes, clear project management plans, and low team conflict [14]. On the other hand, when students perceive that students from one discipline have more assigned tasks than students from another discipline, they can perceive the course to be unfair [15]. Additionally, when students do not understand how much effort is required to complete discipline-specific tasks, it may be more difficult for them to perceive the workload as fair on a multidisciplinary team [12]. Thus, managing team dynamics and perceptions of fairness are important considerations when designing a multidisciplinary course or collaborative project.

3. Methods

3.1 Participant Demographics

The participant demographics are presented in Table 1. The PRD students generally had more gender diversity than the ECE students, while the ECE students had greater racial and ethnic diversity.

Table 1. Participant Demographics

	Cohort 1	**Cohort 2**
ECE Demographics		
Women	14%	19.7%
Men	84.4%	79.8%
Other/unknown gender	1.6%	0.5%
Asian	8.2%	8.3%
Black	2.9%	5.2%
Hispanic/Latino	4.7%	5.2%
Native Hawaiian/Pacific Islander	0%	0.5%
White	77.8%	69.9%
Multiracial	4.1%	5.7%
International Students	1.2%	4.1%
Unknown race/ethnicity	1.2%	1.0%
PRD Demographics		
Women	44.44%	40%
Men	55.56%	60%
Asian	14.3%	0%
Hispanic/Latino	14.3%	0%
White	71.2%	100%

3.2 Course Structure

The ECE Capstone Design course at the University of Kentucky is set up in a two-semester sequence with a fall-spring cohort and a spring-fall cohort. As the associated PRD course is a fall course, these collaboration between ECE and PRD students took place in the larger fall-spring cohort. The ECE capstone course meeting schedule includes a Monday/Wednesday lecture (50 minutes) and Tuesday/Thursday lab (75 minutes). Initially, all four days involve lecturing, but as the semester progresses, the Tuesday/Thursday lab meetings become work time for the student groups to complete their projects. Because there is built in work time in the class schedule, the ECE capstone student teams typically do not meet much outside of class to work together, if at all. Lectures are focused on explicit course topics such as how to define a need and objective for the project, how to identify customer needs (Marketing Requirements) and how to translate those into Engineering Requirements. Additional topics include project management topics like Gantt charts and work breakdown structures, basic cost analysis and budgeting, as well as basic lectures on teamwork. The second semester lectures provide guidance on how to finish the project on time, how to provide the required documentation, and other similar topics. Thus, most of the lecture material is general enough to be relevant to a student from any discipline, as few topics related only to electrical and computer engineering.

The PRD students were enrolled in a studio course that meets on Monday/Wednesday/Friday. The course meetings were three hours long during cohort one (a five-credit hour course) and were reduced to two hours and fifteen minutes long (a four-credit hour course) for cohort two due to a change in the PRD curriculum. The Monday/Wednesday meeting times overlapped with the ECE course meeting times during both cohorts.

3.3 Team Formation and Project Selection

During the first week of the first semester, instructors presented project options to students and project teams were formed. Most projects involved a sponsor who was either a faculty or staff member at the university or an outside company. Students self-selected into groups of four to six students based on project interest. Prior to the group formation meeting, the ECE and PRD instructors discussed which projects might be most suitable for including a PRD student. These were typically projects that need a housing to be built or that involve an important user interaction component. The PRD students were then encouraged to join those groups. The PRD students were asked to split up into different groups rather than working together. The projects that included a PRD student in cohort 1 were two drone projects, an electric boat project, and four adaptive toy/game projects sponsored by a physical therapist. The projects that included a PRD student in cohort 2 were an electric boat project, an adaptive toy project, a music education device, a wearable sensor for runners, and an interactive kids' game.

3.4 Course Assignments

Once the design requirements have been determined, the teams break down the overall project into subprojects and assign a subproject to each team member. This structure worked well for multidisciplinary teams, as the PRD student was typically assigned to work on the outer housing and/or user interface design. The teams were directed to complete an initial prototype by the end of the first semester. In the second semester, the main focus was finalizing the prototypes. Students focus on final integration, testing, and documentation, and present the final prototype and design in an hour-long presentation near the end of the semester. The course sequence ends with a final showcase where the students present their final prototype to the public.

To help instructors monitor team dynamics and identify potential problems with which they may need to intervene, each individual student was required to submit three self/peer evaluations during each semester. The self/peer evaluation forms are described in further detail in the following section.

3.5 Self/peer Evaluation Forms

The purpose of the self/peer evaluation forms was for the instructors to gauge how well the teams were working together and to get insight into each team member's individual contributions. Section one of the form asks students to rate each team members on their expected actions such as attending meetings and meeting deadlines. Section two of the form asks students to distribute 100 points among the team members, considering their relative contributions to the project (Figure 1). Students were discouraged from assigning each team member an equal score, since that was unlikely to accurately reflect the distribution of work. Although students completed the forms three times during each semester, only fall semester scores were used for the comparisons presented in this paper.

SECTION 2. Distribute 100 points among the team members, considering the relative contribution (such as amount of work performed, teamwork, leadership, etc.) of each member of the team, with more points being given to members with the stronger performance. Explain your ratings in the comments. Include yourself in the list.

	Team Member	Points	Comments
1			
2			
3			
4			
5			
6			
	TOTAL	100	(points need to add to 100)

Figure 1. Section two of the self/peer evaluation form used in the ECE capstone course

3.6 Quantitative Analysis of Self/Peer Evaluation Form Scores

Teams had between four and six members, so to enable a consistent comparison, all scores on the self/peer evaluation forms were scaled as if each team had five members. The following research questions guided our analysis of the scores:

RQ1: Is there a significant difference in the way ECE students rated their PRD teammates versus their other ECE teammates? (H0: There is no difference. H1: There is a difference.)

RQ2: Is there a significant difference in the way ECE students rated PRD teammates in cohort one versus in cohort two? (H0: There is no difference. H1: There is a difference.)

To answer RQ1, we only looked at the cases where ECE students were rating their teammates. We did not include ratings provided by PRD students, and we did not include self-ratings. We performed a two-sided t test to look for significant differences in scores by major. We analyzed each cohort's data separately for RQ1. To answer RQ2, we looked only at the ECE students' ratings of their PRD teammates. We performed a two-sided t test to look for significant differences between the two cohorts.

3.7 Analysis of Open-Ended Comments on Self/Peer Evaluation Forms

Section 2 of the self/peer evaluation form also elicited open-ended comments from students about their teammates (see Figure 1). In the results section, we provide some examples of comments which provide further insight into why ECE students rated their PRD teammates higher or lower across the cohorts.

4. Results

4. 1 Self/peer Evaluation Score Results

To answer RQ1 (*Is there a significant difference in the way ECE students rated PRD teammates versus other ECE teammates?*) we first confirmed that the score data followed a normal distribution, then performed a two-tailed t test. For cohort 1 in Fall 2024, results indicated that there was no significant difference between the PRD students' scores ($M = 20.00$, $SD = 4.84$) and the ECE students' scores ($M = 20.23$, $SD = 3.79$), $t(394) = -.461$, $p = .323$. For cohort 2 in Fall 2025, results indicated that the PRD students' scores ($M = 17.30$, $SD = 4.5$) were significantly lower than the ECE students' scores ($M = 20.59$, $SD = 2.77$), $t(64.680) = -5.024$, $p < .001$.

In order to answer RQ2 (*Is there a significant difference in the way ECE students rated PRD teammates in cohort 1 versus in cohort 2?*) we first confirmed that the score data followed a normal distribution, then performed a two-tailed t test. Results indicated that the PRD students' scores in cohort 1 ($M = 20.00$, $SD = 4.84$) were significantly higher than the PRD students' scores in cohort 2 ($M = 17.30$, $SD = 4.51$), $t(141) = 3.311$, $p = .001$. (We note that one submission from one ECE student was missing from fall 2025, though we do not believe that a single missing submission had an impact on the overall results.)

4.2 Qualitative Comments on the Self/Peer Evaluation Forms

The positive comments from cohort 1 were primarily related to the unique contributions that the PRD students made to the projects based on their design skills. The following are representative examples:

> "[PRD student] has blown my expectations out of the water and made a lot of daunting tasks so much easier with his design skills." – Cohort 1 ECE teammate

> "Made a good quality design prototype that lets us see and think of our component location." – Cohort 1 ECE teammate

> "[PRD student's] talent and effort add so much to our project. She makes our work look professional and complete to a level that we could not have accomplished without her." – Cohort 1 ECE teammate

The negative comments from cohort 1 were primarily related to poor communication or unsatisfactory design work on the part of the PRD students. Examples follow:

> "[PRD student is] least available, lack of communication, but he does make contributions to the design." – Cohort 2 ECE teammate

> "[PRD student's] every design proposed failed to align with the project goals, despite receiving multiple rounds of feedback from the team." – Cohort 2 ECE teammate

The positive comments from cohort 2 were again focused on the PRD students' contributions to the design work:

> "[PRD student] works very hard on creating ways to improve our product and his assigned subproject." – Cohort 2 ECE teammate

> "[PRD student] did all of the work that we needed him to do and went beyond expectations to contribute to the project. He was a very helpful addition to the team." – Cohort 2 ECE teammate

The negative comments from cohort 2 were primarily focused on the fact that the PRD students were not present at every course meeting and were not perceived to be putting in adequate effort. Despite being told multiple times that the PRD students could not possibly come to the Tuesday/Thursday class sessions due to a schedule conflict, some ECE students appeared very focused on this, as reflected in their comments:

> "[PRD student] rarely works with the group and rarely meets deadlines." – Cohort 2 ECE teammate

> "[PRD student] had a shaky start to the semester in terms of absence and effort." – Cohort 2 ECE teammate

“[PRD student] only does what is asked.” – Cohort 2 ECE teammate

<u>4.3 Proportion of Teams Continuing Together into Second Semester</u>

In the fall of 2024 (cohort 1), all seven product design students were given the opportunity to continue working on the projects with their teams by enrolling in an elective course taught by the product design faculty member. Students were told that this should be a mutual decision among the members of the team. Enrolling in the elective course would allow the PRD students to participate in the Tuesday/Thursday lab portion of the course meetings, but they would not be available to participate in the Monday/Wednesday course meetings due to a conflict with another required course. Thus, some work would need to be completed outside of class time. Of the seven PRD students in cohort 1, six opted to continue working with their teams.

In the fall of 2025 (cohort 2), all five product design students were again provided with an opportunity to continue working on the projects with their teams by enrolling in an independent study course. Of the five students, only one expressed interested in enrolling in this course to continue the collaboration formally. One of the students did not have the option available since they would be studying abroad. The other three students voiced interest in helping their teams with prototyping tasks as needed but did not want to enroll formally in the course.

5. Discussion

Our results suggest that the structure of the collaboration in cohort 1 yielded a better experience for both the PRD and ECE students compared to the structure used for cohort 2. The cohort 1 PRD students were evaluated more positively by their ECE teammates compared to cohort 2, and these differences were statistically significant. Furthermore, in cohort 1, there was no statistically significant difference between ECE student and PRD student scores on the teammate evaluations, indicating that the PRD students were viewed as equally valuable members of the team in comparison to the other ECE team members. The comments in the self/peer evaluations reinforced the idea that PRD students were being seen as valuable team members. The fact that six of the seven PRD students in cohort 1 chose to continue working with the teams for a second semester further reinforces that the PRD students were well-engaged with the team and enjoyed working with them.

In contrast, in cohort 2, PRD team members received significantly lower scores than ECE team members on the self/peer evaluations, indicating that PRD students were viewed as lesser contributors and less valuable team members. The comments on the self/peer evaluations suggested that the PRD students’ absence from the Tuesday/Thursday course meetings, while inevitable due to schedules, likely influenced the ECE students’ impressions of the PRD students’ commitment to the projects. Thus, the PRD students may not have felt like full members of the team, both in their own minds and in the minds of the ECE team members. As demonstrated by the ECE students' comments in the self/peer evaluation form, some of them appeared to resent the absence of the PRD students from the lab meetings. The PRD students shared with their instructor that on the days they could not be in class, the ECE team members often made important decisions about the project without their input and failed to keep the PRD students up to date about these decisions, which hindered the PRD students' ability to keep their work aligned with the rest of the team. The PRD students were frustrated by this and likely less invested in the projects as a result.

This study was not a controlled experiment with randomly assigned groups, as we were comparing the course in two different years with multiple variables. Our data very strongly suggests that teams experienced better unity in cohort 1 than in cohort 2, but the underlying reasons for this are more speculative. Since the two cohorts involved different groups of students, it is possible that the PRD students in cohort 2 were indeed weaker team members than the ones in cohort 1 and were thus seen as less valuable by the ECE teams. Other factors may have played a role as well, including the fact that some cohort 2 PRD students were considering studying abroad in the spring semester, which may have limited their investment in the project, even if they did not ultimately study abroad. The PRD students in cohort 2 also had a higher course load than the PRD students in cohort 1 because of a curriculum change in the PRD department and thus may have had less time to dedicate to the project. While all of these other factors likely played a role in the differences in team unity in cohorts 1 and 2, the comments on the self/peer evaluation forms mentioned the lack of attendance in Tuesday/Thursday lab meetings as a problem, thus, we are confident that this factor was at least a partial contributor to the differences that we found.

Our results echo findings of other studies of multidisciplinary capstone collaborations. For example, Setiawan and colleagues found that some students in a multidisciplinary capstone course perceived the workload to be unequal between the students from different disciplines because of the nature of the tasks covered by the disciplines [15]. Additionally, some students found the differences in project schedules and timelines across the different majors difficult [15]. Scheduling was also an issue for our students, and while the descriptions of group members not contributing equally in our study were mainly focused on attendance and contributions to assignments, the differences in disciplinary focus may have played a role as well.

Another similar study describes a collaboration where product design students worked on biomedical engineering capstone teams for the first semester of a year-long project [12]. The study concluded that the imbalance in the structure of the collaboration, in that one discipline's students were joining another discipline's class on "their" project, was a limiting factor to the collaboration's success [12]. In that collaboration, no groups opted to work together into the second semester, and the biomedical engineering students who had been grouped with weaker members of the product design class expressed the most negative opinions about the collaboration after the fact [12]. While we did not account for the skill level of the PRD students in our analysis, continuing the collaboration into the second semester was a mutual decision among all team members and the product design students who were seen as strong, skilled contributors were more likely to be encouraged by their ECE teammates to continue. The study of the biomedical engineering and product design collaboration also found that engineering students were focused on team performance and workload, while the product design students were focused on creating work that would present well in a design portfolio [12]. Our students likely had similarly disparate goals, as illustrated by the ECE student comment which complained that the PRD student was the least available and least communicative member of the group, yet still made contributions to the design. Future research should more formally investigate disciplinary differences in student motivation in multidisciplinary capstone collaborations like ours.

6. Conclusion

Our observations in this course support the idea that incorporating PRD students into an ECE capstone design course can lead to positive teammate experiences. This was supported by the analysis of the self/peer evaluation forms, which showed no difference in teammate evaluation ratings between PRD and ECE students, and the high rate of continuity in the teams working together into an optional second semester. However, our findings suggest that multidisciplinary collaborations are not always successful with regard to team unity, as our second cohort did not show the same results. Our findings suggest that successful collaborations are likely best facilitated by students being present together for all course meetings, although other factors may also play a role. We recommend that educators who are designing multidisciplinary collaborations consider the course structure and attempt as much as possible to create a sense of equality among the students by having them present together in the same course.

List of References

[1] A. Moyal, “How Engineering Education Can Change To Meet The Industry’s Needs,” Forbes. Accessed: Apr. 28, 2025. [Online]. Available: https://www.forbes.com/councils/forbesbusinesscouncil/2022/07/14/how-engineering-education-can-change-to-meet-the-industrys-needs/

[2] E. May and D. S. Strong, “Is Engineering Education Delivering What Industry Requires,” *PCEEA*, Aug. 2011, doi: 10.24908/pceea.v0i0.3849.

[3] D. Gürdür Broo, O. Kaynak, and S. M. Sait, “Rethinking engineering education at the age of industry 5.0,” *Journal of Industrial Information Integration*, vol. 25, p. 100311, Jan. 2022, doi: 10.1016/j.jii.2021.100311.

[4] K. Kövesi and P. Csizmadia, “Industry perception of new engineering graduates: the gap between requirements and reality,” presented at the 44th SEFI Conference, Tampere, Finland, 2016.

[5] G. Hunt, "Board 98 : A Case Study of Interdisciplinary Capstone Engineering Design," in *2018 ASEE Annual Conference & Exposition Proceedings*, Salt Lake City, Utah: ASEE Conferences, Jun. 2018, p. 30149. doi: 10.18260/1-2--30149.
[6] B. Rhoads, C. Whitfield, J. Allenstein, and P. Rogers, "Examining the Structure of a Multidisciplinary Engineering Capstone Design Program," in *2014 ASEE Annual Conference & Exposition Proceedings*, Indianapolis, Indiana: ASEE Conferences, Jun. 2014, p. 24.560.1-24.560.17. doi: 10.18260/1-2--20451.
[7] L. Zheng, D. Hu, and B. Jesiek, "A Systematic Review of Multidisciplinary Engineering Education: Accredited Programs, Educational Approaches, and Capstone Design," in *2021 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual Conference: ASEE Conferences, Jul. 2021, p. 36621. doi: 10.18260/1-2--36621.
[8] A. Ritenour, C. Ferguson, P. Gardner, B. Banther, and J. Ray, "Collaborative Project-Based Learning Capstone for Engineering and Engineering Technology Students," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 34300. doi: 10.18260/1-2--34300.
[9] A. Qattawi, A. Alafaghani, M. A. Ablat, and M. S. Jaman, "A multidisciplinary engineering capstone design course: A case study for design-based approach," *International Journal of Mechanical Engineering Education*, vol. 49, no. 3, pp. 223–241, Jul. 2021, doi: 10.1177/0306419019882622.
[10] N. Hotaling, B. B. Fasse, L. F. Bost, C. D. Hermann, and C. R. Forest, "A Quantitative Analysis of the Effects of a Multidisciplinary Engineering Capstone Design Course," *J of Engineering Edu*, vol. 101, no. 4, pp. 630–656, Oct. 2012, doi: 10.1002/j.2168-9830.2012.tb01122.x.
[11] R. Bachnak, A. Attaluri, and M. Abu-Ayyad, "Promoting Multidisciplinary Industry-Sponsored Capstone Projects," *ASEE*, 2020.
[12] K. A. Bartlett, W. D. Ferriell, and J. Mills, "What Happens When Biomedical Engineering Students and Product Design Students Design Medical Devices Together? Evaluating a New Collaborative Course," presented at the American Society for Engineering Education Annual Conference & Exhibition, Portland, Oregon, 2024. doi: 10.18260/1-2--48268.
[13] E. Comber *et al.*, "WIP: Engineering and Industrial Design Sub-teams for a Multi-disciplinary Biomedical Engineering Design Course," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 35539. doi: 10.18260/1-2--35539.
[14] M. Mostafapour and A. Hurst, "An Exploratory Study of Teamwork Processes and Perceived Team Effectiveness in Engineering Capstone Design Teams," *International Journal of Engineering Education*, vol. 36, no. 1, pp. 436–449, 2020.
[15] A. W. Setiawan *et al.*, "Multidisciplinary Capstone Design Project: Biomedical Engineering, Mechanical Engineering, Engineering Management and Product Design," in *2023 32nd Annual Conference of the European Association for Education in Electrical and Information Engineering (EAEEIE)*, Eindhoven, Netherlands: IEEE, Jun. 2023, pp. 1–5. doi: 10.23919/EAEEIE55804.2023.10181963.